REMARKS

Claims 8-9, 11-17 and 25-26 will be pending upon entry of the present amendment. Claims 1-7, 10 and 18-24 are hereby canceled without prejudice. No claims are amended. No new matter is being presented.

Applicants thank the Examiner for indicating the allowability of the subject matter of claims 25 and 26. In the Final Office Action, The Examiner objected to these claims as being dependent upon a rejected base claim, but indicated that they would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Because claims 25 and 26 depend on allowable base claims 8 and 11, respectively, as discussed below, Applicants respectfully submit that pending claims 25 and 26 are in condition for allowance.

Applicants respectfully request the Examiner to reconsider the rejections of the currently pending claims, as each of the currently pending claims includes features and provides functionality that is nowhere taught by the cited references and is, thus, in condition for allowance.

In general, the pending claims are related to techniques for encoding moving pictures sequences, such as digital video encoding. In some embodiments, such techniques may include adaptively selecting between multiple different motion estimation schemes based on motion characteristics of a moving pictures sequence. This allows for automatic selection of a motion estimation scheme that is well suited for a sequence based on determined motion characteristics, such as to select a motion estimation scheme for the sequence that gives a good tradeoff between accuracy and computational complexity. For example, one motion estimation scheme may be well suited in terms of accuracy and computational complexity for a sequence that contains fast motion, while a different motion estimation scheme may well suited for a sequence that contains slow motion, etc. In some embodiments, each of the multiple different motion estimation schemes that are selected between has a different combination of block matching techniques and number of global motion vectors. None of the cited references, alone or in combination, teaches or suggests selecting between multiple different motion estimation schemes based on motion characteristics as recited in various of the pending claims.

In the Final Office Action, claims 8 and 16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan et al. (GB2308774) in view of Harradine et al. (U.S. Patent No. 4,862,260).

Morgan and Harradine do not disclose the invention recited in pending claim 8. Pending claim 8 recites a method for encoding moving pictures data that includes in part:

> analyzing the global motion vectors and determining <u>a metric representing a distribution pattern</u> thereof;
>
> <u>selecting a motion estimator scheme</u> on the basis of <u>the distribution pattern metric</u>, the motion estimator scheme being selected from amongst <u>a plurality of motion estimator schemes</u> each having <u>a different combination</u> of <u>block-matching search methods</u> and <u>numbers of global motion vectors</u>;
>
> performing data block-matching with a reference picture using the selected motion estimator scheme to generate a block motion vector. . .

Morgan and Harradine do not include any teaching or suggestion of determining a metric representing a distribution of global motion vectors and using such a metric to select between plural motion estimator schemes. The Examiner appears to equate Morgan's method of determining global motion vectors and Morgan's process for selecting a motion vector for pixel interpolation with recitations of claim 8 related to a distribution pattern metric. *See* Final Office Action, page 4. Applicants disagree. Morgan determines global motion vectors by counting the occurrence of local motion vectors (excluding "long vectors") and selecting the eight most commonly occurring local motion vectors that pass various threshold tests (such as a "predetermined difference threshold" and a "global threshold") as global motion vectors. Morgan page 15, lines 5-32, to page 16, lines 1-5. However, such determining of global motion vectors is not related to analyzing global motion vectors to determine a metric representing a distribution pattern of those global motion vectors. In particular, such a determination of global motion vectors does not include anything remotely related to <u>a metric</u> representing <u>a distribution pattern of global motion vectors</u>, and certainly does not determine such a metric. Moreover, it does not make logical sense for Morgan's method of determining global motion vectors to be based on a distribution pattern metric of global motion vectors that have yet to be determined.

The Examiner also references sections of Morgan that discuss a global vector restrictor which associates each of the determined global motion vectors with blocks of the input image at or near areas where motion identical or similar to the motion represented by the global motion vector was originally derived. See Final Office Action, page 4 (citing Morgan page 12, line 31, to page 13, line 8, and page 16 lines 25-28). However, such association does not teach or suggest determining <u>a metric representative of a distribution pattern of global motion vectors</u>, as recited in claim 8. In particular, there is no such metric. Instead, Morgan simply associates each determined global motion vector with blocks that are similar to the global motion vector. Morgan does this to prevent a global motion vector from being assigned during vector selection to blocks that have significantly different motion than that of the global motion vector. Morgan, page 16, lines 22-31.

Morgan describes its vector selection process as follows:

> . . . The motion vector selector 230 supplies an output comprising one motion vector per pixel of the output field. This motion vector is selected from the four motion vectors for that block supplied by the motion vector reducer 220 [including a zero motion vector and 3 other motion vectors that pass a confidence test and may include global motion vectors].
>
> The vector selection process involves detecting the degree of correlation between test blocks of the two input fields pointed to by the motion vector under test. The motion vector having the greatest degree of correlation between the test blocks is selected for use in interpolation of the output pixel. . . . Morgan page 10, line 30, to page 11, line 8.

As is clear from the above quoted passage, Morgan's vector selection process does not include any teaching or suggestion of anything even remotely related to determining a metric representing a distribution pattern of global motion vectors. Instead, Morgan tests a set of four motion vectors that may include global motion vectors to determine which vector should be selected for pixel interpolation.

Furthermore, Morgan does not teach or suggest selecting a motion estimator scheme on the basis of a metric representing a distribution pattern. Not only does Morgan not teach or suggest multiple motion estimator schemes (as discussed in detail below), but also, as should be clear from the above quoted passage, Morgan's vector selection process does not include any type of selection on the basis of <u>a metric representing a distribution pattern of global</u>

motion vectors. Instead, Morgan selects four candidate motion vectors to associate with an image block on the basis of a confidence test and selects a motion vector from the set of candidate motion vectors on the basis of performing the correlation test for each candidate vector. In addition, Morgan's global vector restrictor and method of determining global motion vectors (discussed above) do not include any teaching or suggestion of using a metric representing a distribution pattern of global motion vectors for selecting a motion estimator scheme, as neither includes any teaching or suggestion of such a metric.

In addition, the polar histogram of Harradine does not appear to include any teaching or suggestion of determining a metric representing a distribution of global motion vectors and using such a metric to select between plural motion estimator schemes. Furthermore, the Examiner does not appear to cite Harradine for such a teaching or suggestion. Thus, Harradine does not remedy the shortcomings of Morgan.

For at least the foregoing reasons, Applicants respectfully submit that pending claim 8 is allowable over Morgan and Harradine.

Furthermore, Morgan and Harradine further do not include any teaching or suggestion of plural motion estimator schemes that differ from each other with respect to block-matching search methods and numbers of global motion vectors or any selection between such plural motion estimator schemes, as recited in claim 8. Instead, Morgan discloses only a single motion estimation scheme in which a block matcher calculates correlation surfaces representing spatial correlation between blocks of two input fields, a correlation surface processor generates interpolated correlation surfaces, and a motion vector estimator detects points of greatest correlation in the interpolated correlation surfaces. Morgan page 9, lines 4-12. Morgan is not specific as to how the block matcher, correlation surface processor, and motion estimator perform searching to estimate the motion vectors, but nowhere suggests that a block-matching search method is varied in any way or that there is any selection between plural motion estimator schemes that employ various combinations of global motion vectors and block-matching search methods as recited in claim 8.

The Examiner continues to assert that Morgan's vector selection process discloses such recitations of claim 8. Final Office Action, pages 4 and 10-11. Applicants continue to

disagree. As noted above, Morgan selects four candidate motion vectors, tests each of the candidate vectors to determine which has the highest degree of correlation, and chooses the candidate vector with the highest degree of correlation to interpolate a pixel from an image block. The Examiner points out that the candidate vectors may vary from one iteration to the next, such that the tested portion of the input fields will vary based on where each candidate vector points (the Examiner refers to this as a "search pattern"). Applicants agree that some of the motion vectors of a set of four motion vectors associated with an image block may vary from one image block to the next, and that such motion vectors may point to different test blocks of the two input fields when subjected to the correlation test. However, Applicants disagree with the Examiner's assertion that such variance in motion vectors is analogous to multiple different motion estimator schemes that are selected between as recited in claim 8. Rather, Morgan's vector selector simply employs the same correlation test (*e.g.*, determine which motion vector of a set has the highest degree of correlation) with potentially different sets of candidate motion vectors from one iteration to the next, and does not select a motion estimator scheme from a plurality of different motion estimation schemes. The Examiner incongruously states that "[t]he terms [scheme and method] similarly relate to a process of achieving a desired result," and then suggests that because Morgan's motion vectors vary from one iteration to the next (*e.g.*, different "search patterns" from one iteration to the next), then Morgan's process also differs from one iteration to the next. Final Office Action, pages 10-11. However, Morgan's vector selection process remains the same from one iteration to next; it is only the input that varies (*e.g.*, the set of candidate motion vectors). The following passage of Morgan supports that Morgan's vector selection process remains that same regardless of what motion vectors are supplied:

> . . . It has been observed that rapidly moving portions of a video image have lower spatial detail than stationary or slowly moving portions. This means that even if a motion vector can be estimated which accurately represents the rapid motion of the object, the correlation test performed in the vector selector 230, which relies on detecting correlation between parts of the same object in two successive input fields, can be unreliable. It is therefore preferable to prevent such long vectors from being selected as global vectors to ensure that a large magnitude global vector cannot be incorrectly selected for interpolation of image areas where there is in fact only very small motion. This could produce subjectively disturbing effects in the output image. Morgan, page 14, lines 5-14.

Morgan simply does not appear to include any teaching or suggestion of multiple motion estimator schemes that employ various combinations of global motion vectors and block-matching search methods, and certainly does not select between such motion estimator schemes based on a metric representing a distribution pattern of global motion vectors, as recited in claim 8.

In addition, the polar histogram of Harradine does not appear to include any teaching or suggestion of multiple motion estimator schemes and selecting between such schemes. Furthermore, the Examiner does not appear to cite Harradine for such teaching or suggestion. Thus, Harradine does not remedy the shortcomings of Morgan.

Thus, for at least the additional foregoing reasons, Applicants respectfully submit that pending claim 8 is allowable over Morgan and Harradine.

Claim 16 depends from claim 8, and is thus also allowable over Morgan and Harradine for at least those reasons discussed with respect to claim 8.

Claims 9 and 17 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of Harradine and in further view of Yagasaki et al. (U.S. Patent No. 5,428,396). Morgan, Harradine and Yagasaki do not teach or suggest the invention recited in claims 9 and 17, which depend from claim 8. Yagasaki does not teach or suggest the features of claim 8 that are missing from Morgan and Harradine. For example, Yagasaki's motion vector variable length coder (VLC) does not teach or suggest selecting between plural motion estimator schemes as recited in claim 8. Accordingly, claims 9 and 17 are allowable over Morgan, Harradine, and Yagasaki for at least this reason.

Claims 11-12 and 14 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of Harradine and in further view of Krause et al. (U.S. Patent No. 5,093,270).

The combination of Morgan, Harradine, and Krause do not teach or suggest the invention recited in pending claim 11. Pending claim 11 recites an encoder that includes, in part:

> <u>a motion characteristics analyzer</u> coupled to receive the global motion vectors from the global motion estimator <u>for analyzing the global motion vectors to determine a metric representing a distribution pattern thereof</u>;

> a selector coupled to receive the distribution pattern metric from the motion characteristics analyzer for selecting a motion estimation scheme from amongst a plurality of motion estimation schemes, for data block matching of at least one subsequent picture in the sequence, each of the plurality of motion estimation schemes having a different combination of data block matching techniques and numbers of global motion vectors; and
>
> a plurality of motion estimators controlled by said selector and coupled to receive said global motion vectors for performing data block matching of at least one subsequent picture in the sequence using the selected motion estimation scheme, said global motion vectors and preselected search window characteristics

Similar to as discussed above with respect to claim 8, Morgan and Harradine to not teach or suggest analyzing global motion vectors to determine a metric representing a distribution pattern of global motion vectors, and, furthermore, does not teach or suggest selecting a motion estimation scheme from amongst a plurality of motion estimation schemes. Thus, for at least those reasons discussed above with respect to claim 8, Morgan and Harradine to not teach or suggest the motion characteristics analyzer or the selector of claim 11. Furthermore, the dual comparison technique of Krause does not appear to teach or suggest the motion characteristics analyzer or the selector of claim 11, and does not appear to remedy the shortcomings of Morgan and Harradine. For example, the even and odd field motion estimators of Krause do not appear to use different combinations of data block matching techniques and numbers of global motion vectors as recited in claim 11. Moreover, Krause states that "[t]he same double comparison is used for each block of odd field 100 of the current frame and for each block of the even field of the current frame." Krause, column 4, lines 66-68. In addition, Krause does not appear to have a selector for controlling a plurality of such motion estimators. For example, Krause appears to have a comparator which receives motion vectors from the odd and even field motion estimators and determines which of the received vectors is closest to the current frame block being processed. Krause, column 5, lines 61-65. Such a comparator is not a selector that controls a plurality of motion estimators as recited in claim 11.

For at least the foregoing reasons, pending claim 11 is allowable over the combination of Morgan, Harradine, and Krause.

Claims 12 and 14 depend from claim 11, and are thus allowable over the relied-upon references for at least those reasons discussed with respect to claim 11.

Claims 13 and 15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Morgan in view of Harradine in view of Krause and in further view of Yagasaki.

Claims 13 and 15 depend from claim 11, and thus are not taught or suggested by Morgan, Harradine, and Krause for at least the reasons discussed above with respect to claim 11. In addition, the VLC of Yagasaki does not teach or suggest the features of claim 11 that are missing from Morgan, Harradine, and Krause. Accordingly, claims 13 and 15 are allowable in view of the relied-upon references.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

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